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(54) A bumper supported on collapsible brackets in front of an axially compressible crush can.

(57) An energy absorbing structure for use on the front or rear of a motor vehicle comprising a bumper unit 12 attachable to a structural part 10 of the motor vehicle by means of two or more bracket assemblies and at least one axially compressible crush can 11 is interposed between the bumper unit 12 and the structural part 10 of the motor vehicle. Each of the bracket assemblies has two arms 13A, 13B which are arranged to collapse upon the application of a low impact load to the bumper unit 12 whereas a considerably higher load is required to cause the crush cans 11 to be collapsed. A two stage progressive collapse of the energy absorbing structure is therefore achieved.

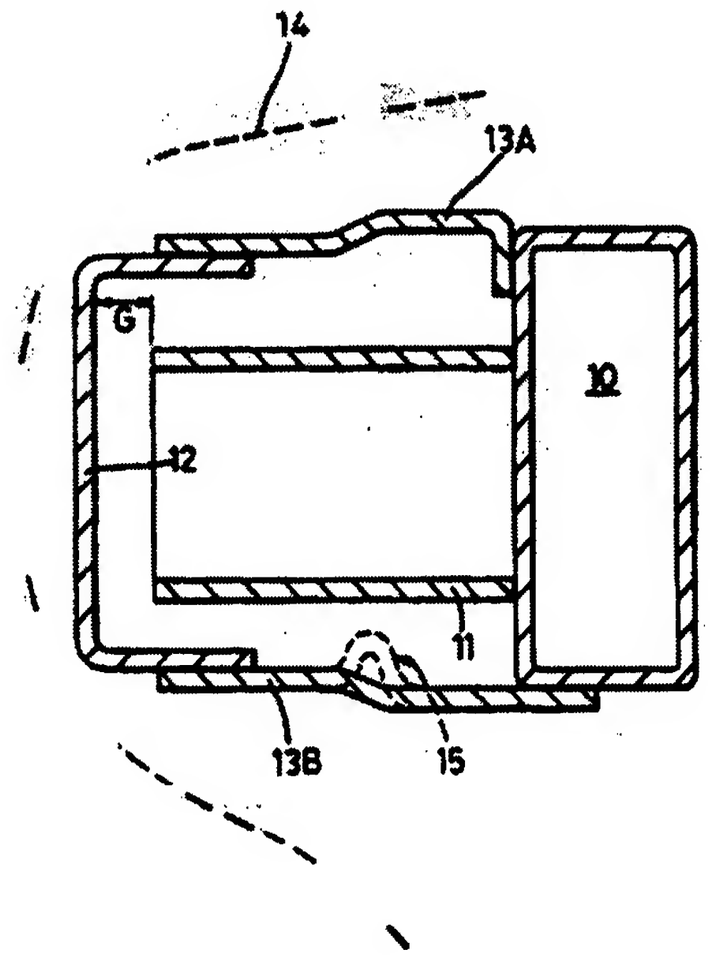

Fig. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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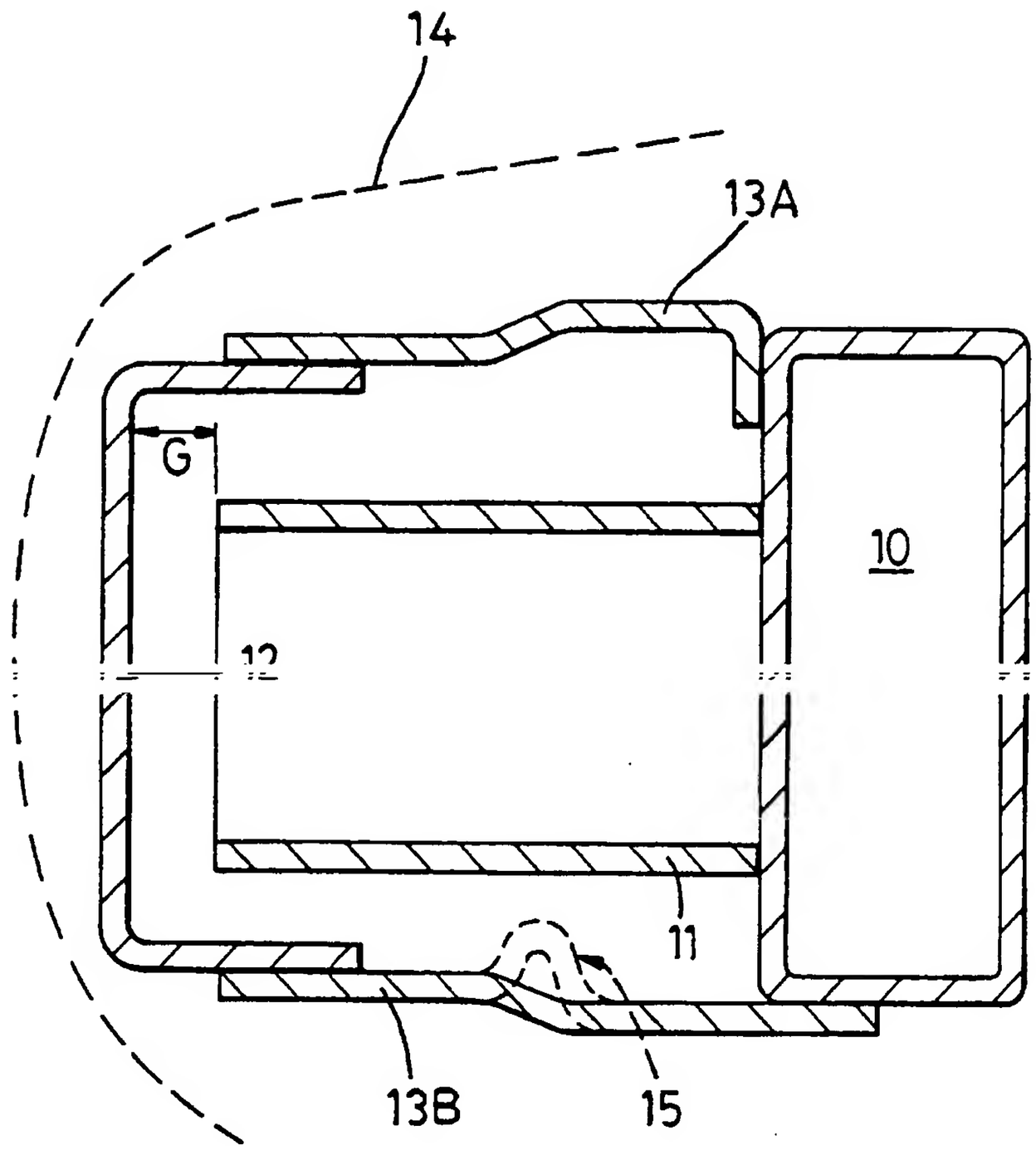

Fig. 1

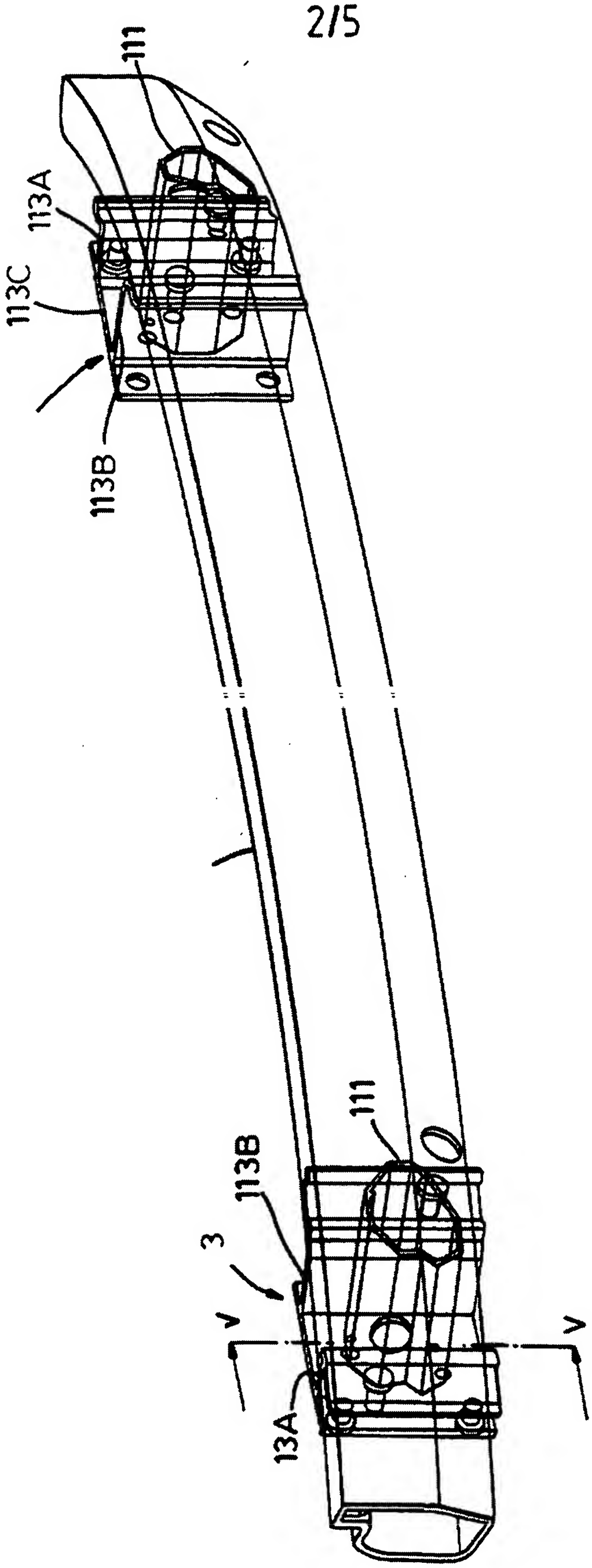

Fig 2

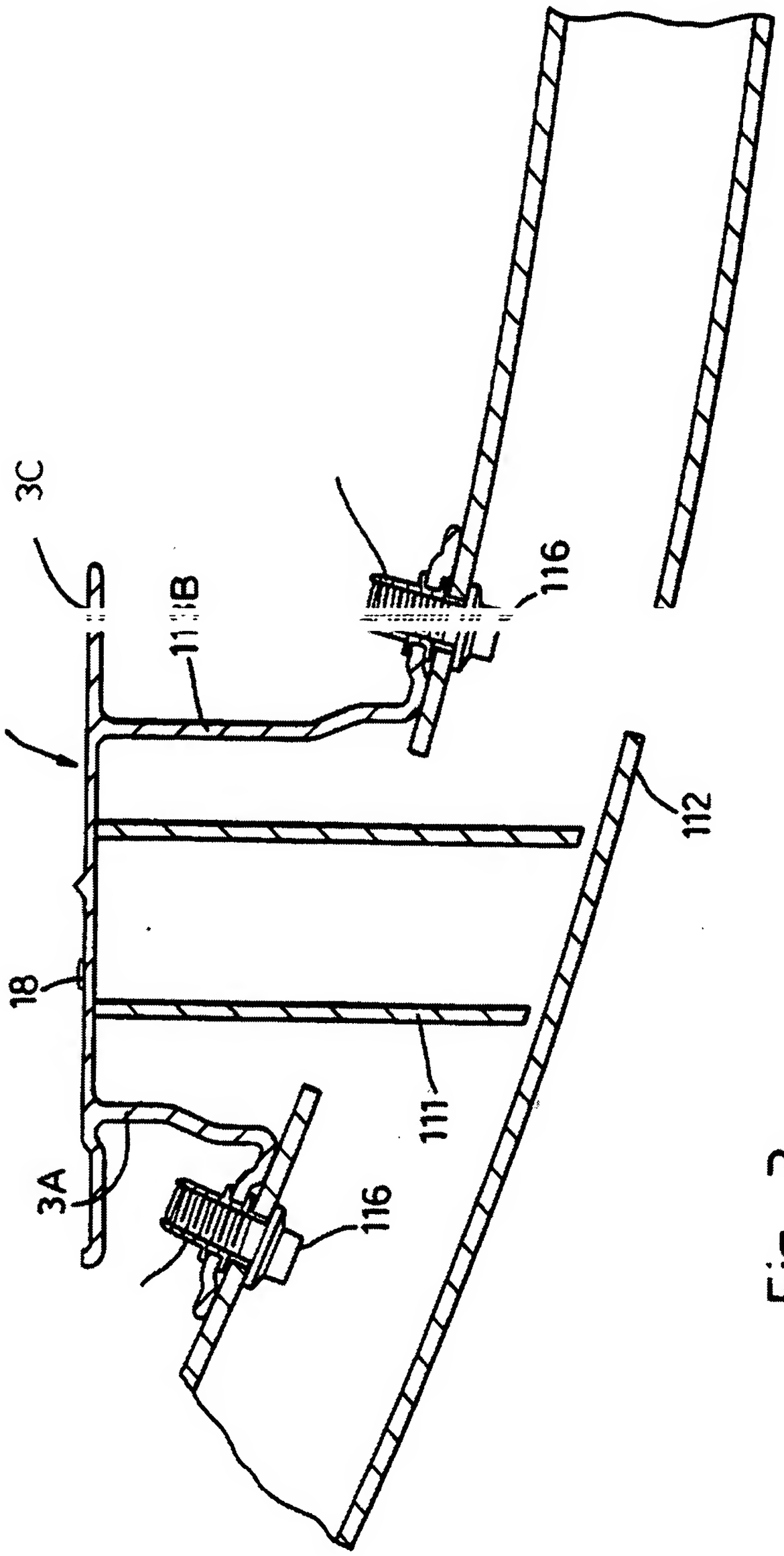

Fig 3

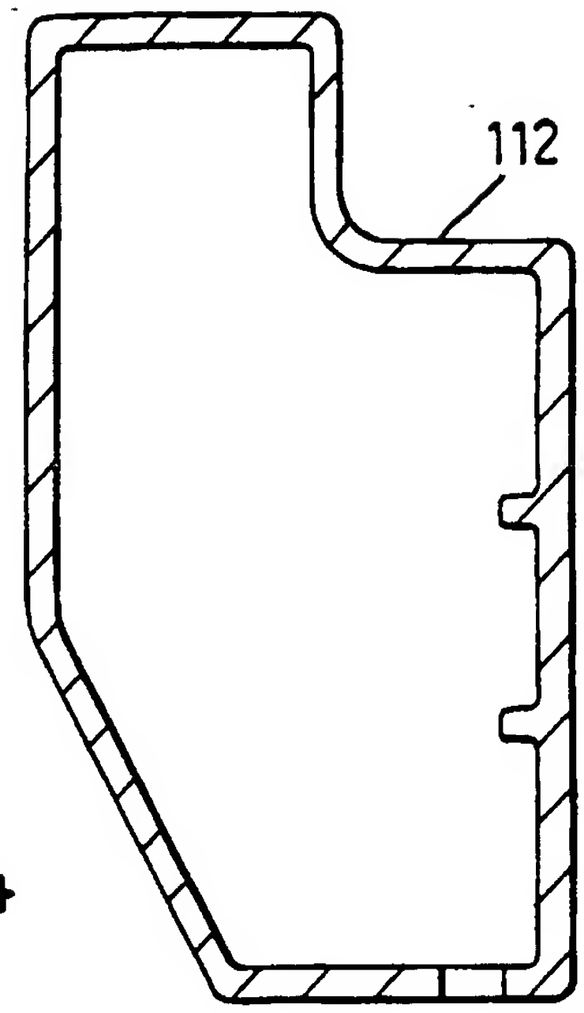

Fig. 4

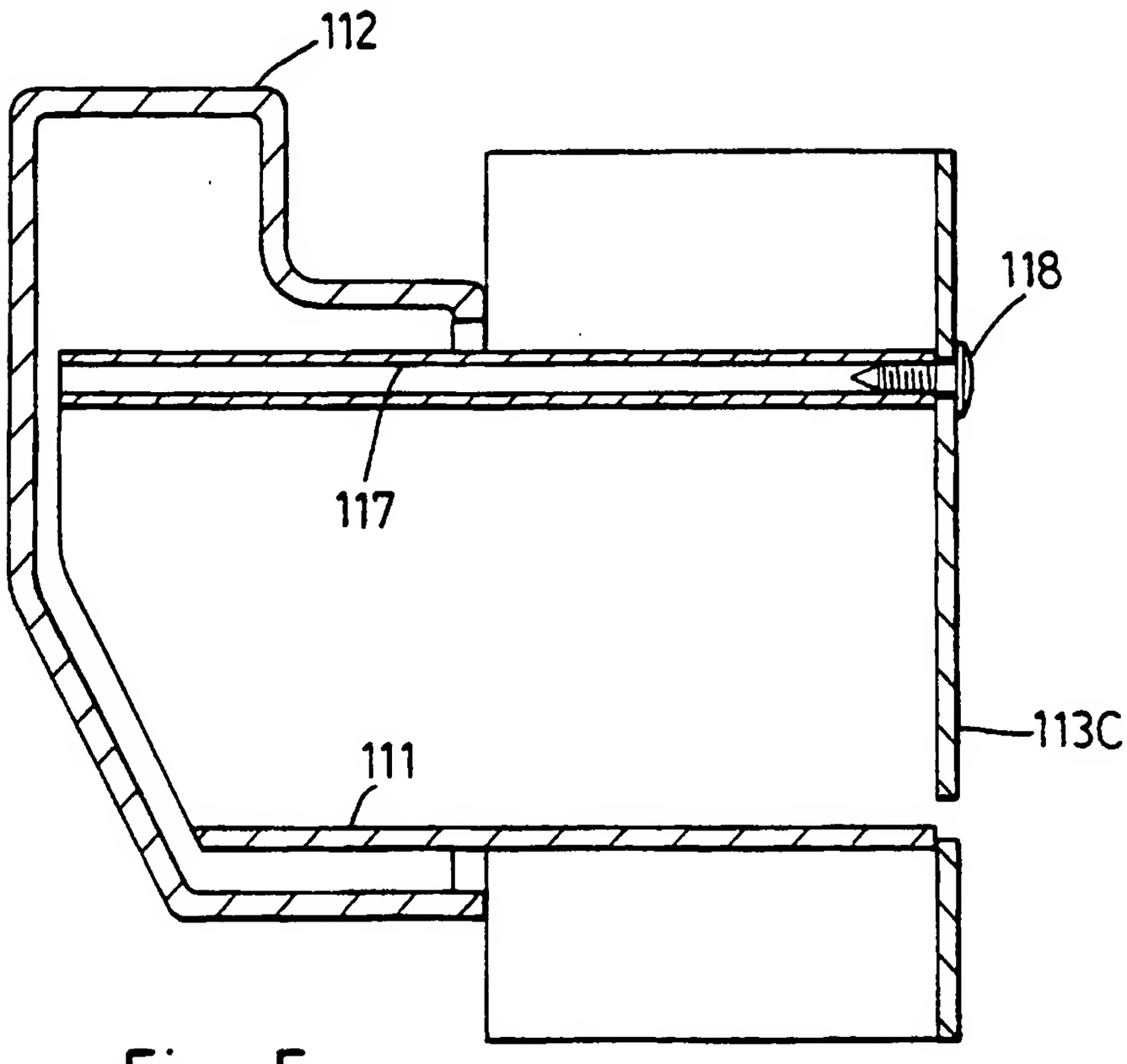

Fig. 5

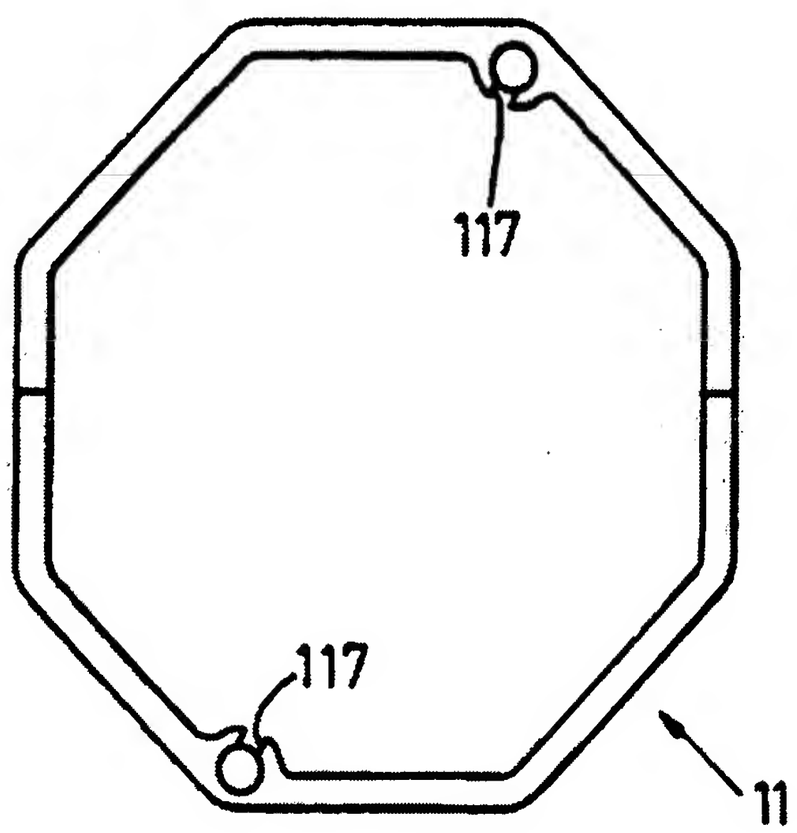

Fig 6

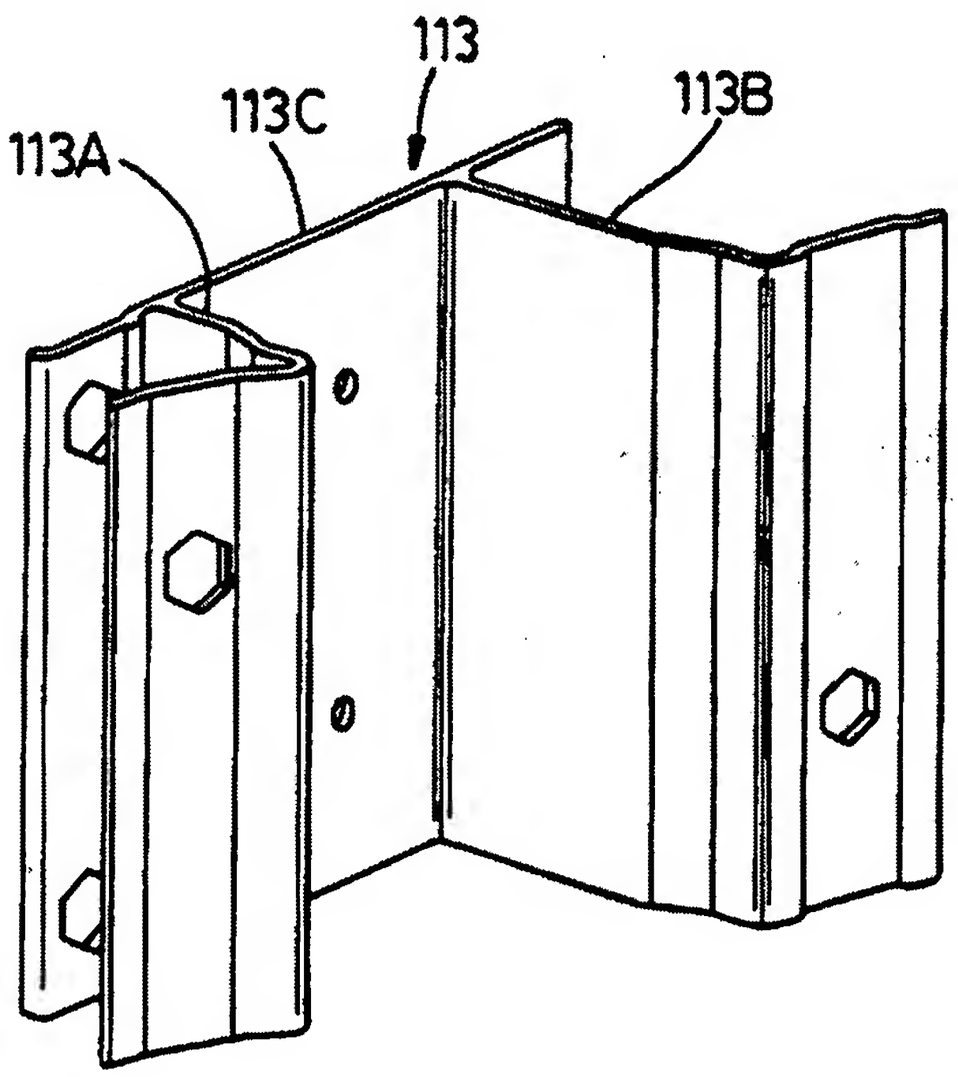

Fig. 7

An impact absorbing structure for a motor vehicle

This invention relates to a motor vehicle and in particular to an impact absorbing structure therefor.

It is known to provide an impact energy absorbing structure for a motor vehicle comprising of a bumper unit connected to a structural part of the motor vehicle by means of one or more axially compressible energy absorbing members in the form of tubular crush cans.

It is a problem with such an arrangement that the crush cans have to be designed to absorb the dynamic loading imposed by the bumper during a major impact which results in the crush cans acting as a relatively rigid connection between the bumper unit and the structure of the motor vehicle during a minor impact.

This has the disadvantage that during a minor impact the crush cans are not compressed and so there is little dampening of the shock of impact. This can result in a premature and unnecessary firing of any airbags fitted to the vehicle during a low speed impact.

According to the invention there is provided an impact energy absorbing structure for a motor vehicle having a substantially rigid bumper unit attachable to a structural part of the motor vehicle by means of two or more bracket assemblies and at least two axially compressible tubular impact energy absorbing members each connected to a

respective one of said bracket assemblies and extending part way towards said bumper unit wherein each of the bracket assemblies is a collapsible bracket assembly that having less resistance to collapse than the tubular impact absorbing members so that upon impact with another object the structure provides a two stage collapse comprising of a first stage in which the bracket assemblies are collapsed by the application of a relatively low impact load and a second stage in which the tubular impact absorbing members are also collapsed by the application of a higher impact load.

Each axially compressible tubular energy absorbing member may be a thin walled aluminium tube.

The bumper unit may be an elongate armature of box-section construction.

The elongate armature may be made from an aluminium alloy by extrusion.

The invention will now be described by way of example with reference to the accompanying drawing of which:-

Fig.1 is a schematic cross-section through an impact absorbing structure according to the invention;

Fig.2 is a pictorial view of an impact absorbing structure according to the invention;

Fig.3 is a cross-sectional plan view of part of the impact absorbing structure shown in Fig. 2;

Fig.4 is a cross-section through an armature forming part of the impact absorbing structure shown in Fig.2;

Fig.5 is a cross-section on the line v-v on Fig.2

Fig.6 is an end view of a tubular impact absorbing member forming part of an impact absorbing structure as shown in Fig.2; and

Fig.7 is a pictorial view of a collapsible bracket forming part of the impact absorbing structure of fig 2.

With reference to figure 1 there is shown an energy absorbing structure comprising of a bumper unit or armature 12 attached to a structural part 10 of the motor vehicle by means of a bracket assembly and an axially compressible tubular energy absorbing member in the form of a crush 11

Although only one bracket assembly and one crush can 11 is shown it will appreciated that a similar arrangement will be used on both sides of the vehicle

The armature 12 is attached to the structural part 10 of the vehicle by means of the bracket assembly such that a gap "G" exists between the armature 12 and the crush 11.

The bracket assembly is formed by two arms 13A, which are so shaped as to provide an easy to collapse structure by having a section that is inclined to normal direction of applied force. In addition the cross-section of the arms 13A, 13B is such that the bracket

assembly represents a relatively easy to collapse structure compared to the crush can 11.

In the event of a low energy impact, such as would occur for a vehicle speed of less than 5 kph, the bracket assembly will be partially collapsed in a controlled manner but the armature 12 will not contact the crush can 11. The energy in such an impact is therefore absorbed by deformation of the arms 13A, 13B as shown diagramatically by reference numeral 15 on Fig.1. The progressive collapse of the arms 13A, 13B reduces the shock transferred to the structural part 10 of the motor vehicle compared to a rigid connection between the armature 12 and the structural part 10.

As most airbags are energised by an accelerometer based sensor the risk of airbag deployment during such a minor impact is therefore greatly reduced as the deceleration perceived by the vehicle will be reduced

As the speed of impact is increased the bracket assembly is unable to absorb the high impact energies produced and is collapsed allowing the armature 12 to contact the crush can 11. At impact speeds over 15 kph the energy to be absorbed results in the crush can 11 undergoing severe deformation and at impact speeds of 30 kph or higher a total collapse of the crush can is likely to occur.

The impact energy absorbing structure therefore provides a two stage collapse, a first relatively soft collapse at impact speeds in which only the bracket arms 13A, 13B are collapsed and a stiffer second stage in which the crush cans 11 are collapsed at higher impact speeds.

As shown by the dashed line on Fig.1 a plastic cover 14 be used to hide the energy absorbing structure from view.

With particular reference to Figs 2 to 7 there is shown an impact absorbing structure which is similar to that described with reference to figure 1.

The energy absorbing structure comprises of a bumper unit or armature 112 which can be attached to a structural of a motor vehicle by means of a pair of collapsible bracket assemblies 113. Each of the bracket assemblies 113 is used to support an axially compressible tubular energy absorbing member in the form of a crush can 111.

The armature 112 is in the form of an elongate box section made from an aluminium alloy material and is connected to the bracket assemblies 113 by means of bolts Each of the bolts engages with a threaded insert 115 held captive on the bracket assembly 113

Each of the bracket assemblies 113 is made from an aluminium alloy by extrusion and has two arms 113A, 113B

extending from a common backplate 113C. Each of the arms 113A, 113B are formed so as to provide an easy to collapse structure by having a joggle formed therein which has a portion inclined to the normal direction of applied force.

In addition the dimensions of the arms 113A, 113B are such that upon the application of a relatively low load they will collapse or buckle in a progressive manner.

Each of the crush cans 111 is connected to a respective one of the bracket assemblies 113 by means of a pair of self tapping screws 118 each of which extends through an aperture in the backplate 113C for engagement with a slotted passage 117 formed in the crush can 111.

As can best be seen in Figs 3 and 5 the crush can 111 extends away from the backplate 113C but does not contact the armature 112.

In the event of a low energy impact, such as would occur for a vehicle speed of less than 5 kph, the bracket assemblies 113 will be partially collapsed in a controlled manner but the armature 112 will not come into contact with the crush cans 111. The energy in such an impact is therefore absorbed solely by deformation of the arms 113A, 113B there being no deformation of the crush cans 111. Because the arms 113A, 113B are designed upon the application of a relatively low impact load to collapse in a controlled manner, the shock transferred to the motor

vehicle is greatly reduced compared to the situation where a rigid connection is used between the armature 112 and the vehicle.

The risk of accidental airbag deployment during such a minor impact is therefore greatly reduced as the deceleration perceived by the vehicle will be reduced by the progressive collapse of the collapsible bracket assemblies 113.

As the speed of impact is increased the bracket assemblies 113 can no longer absorb the higher impact energies produced and the armature 112 will come into contact with the end of the crush cans 111.

At impact speeds over 15 kph the energy to be absorbed is such that the crush cans 111 will undergo considerable deformation and at impact speeds of 30 kph or higher a total collapse of the crush cans 111 and the bracket assemblies 113 is likely to occur.

The impact energy absorbing structure therefore provides a two-stage collapse. A first relatively soft collapse stage at low impact speeds in which only the bracket arms 113A, 113B are collapsed and a stiffer second stage in which the crush cans 111 are also collapsed by the application of a high impact load to the armature 112.

Therefore for impacts at lower speeds and energies only the bracket assemblies 113 will be damaged and not the crush cans 111. Whereas at higher impact speeds both the crush cans 111 and the bracket assemblies will be deformed by the impact.

The use of aluminium alloy for the armature 112, the bracket assemblies 113 and the crush cans 111 provides an impact absorbing structure that is able to absorb a considerable amount of energy during impact but is of lightweight construction.

It will be appreciated that an energy absorbing structure according to the invention is equally applicable for use on the front or rear of a motor vehicle.

CLAIMS

1. An impact energy absorbing structure for a motor vehicle having a substantially rigid bumper unit attachable to a structural part of the motor vehicle by means of two or more bracket assemblies and at least two axially compressible tubular impact energy absorbing members each connected to a respective one of said bracket assemblies and extending part way towards said bumper unit wherein each of the bracket assemblies is a collapsible bracket assembly having less resistance to collapse than the tubular impact absorbing members so that upon impact with another object the structure provides a two stage collapse comprising of a first stage in which the bracket assemblies are collapsed by the application of a relatively low impact load and a second stage in which the tubular impact absorbing members are also collapsed by the application of a higher impact load.

2. An impact energy absorbing structure as claimed in Claim 1 in which each axially compressible tubular energy absorbing member is a thin walled aluminium tube.

3. An impact energy absorbing structure as claimed in Claim 1 or in Claim 2 in which the bumper unit is an elongate armature of box-section construction.

4. An impact energy absorbing structure as claimed in claim 3 in which the armature is made of an aluminium alloy by extrusion.

5. An impact energy absorbing structure substantially as described herein with reference to the accompanying drawing.

The Patent Office

Applicati n No:	**GB 9524465.3**	**Examiner:**	**J. C. Barnes-Paddock**
Claims searched:	**All**	**Date of search:**	**11 January 1996**

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B7B (BSC BSEA BSEB) F2S (SCM)

Int Cl (Ed.6): B60R 19/02, 24, 26, 34, 36

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1,121,332	(LUDWIKOWSKI) Regarding mounting springs as a bracket.	1
X	US 5,116,092	(BMW) Fig. 1, Col 1, lines 54-65	1
A	GB 2,186,240	(FORD) Figs 2 & 4	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
		E	Patent document published on or after, but with priority date earlier than, the filing date of this application.
&	Member of the same patent family		